

Mollusca, Bivalvia, Cuspidariidae, *Plectodon braziliensis* (E. A. Smith, 1915) n. comb.: Record of the genus for the South Atlantic, off Brazil

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ABSTRACT: An analysis of bivalves shells collected off the coast of Rio Grande, Rio Grande do Sul, Brazil and specimens of scientific collections, identified as *Cuspidaria braziliensis* E. A. Smith, 1915 was made. From the examination of syntypes of *C. braziliensis* and the type species of the genus *Plectodon* Carpenter, 1864, a redescription was made and it is proposed to transfer the species to the genus *Plectodon*, resulting in the new combination *Plectodon braziliensis* (E.A. Smith, 1915). This is the first record of a *Plectodon* species for the South Atlantic.

Abbott (1974) listed 51 species in the family Cuspidariidae Dall, 1886. Four species of *Cuspidaria* were recorded from Brazilian coast: *Cuspidaria braziliensis* E. A. Smith, 1915, *C. monosteira* Dall, 1890, *C. platensis* E. A. Smith, 1915 and *C. rostrata* (Spengler, 1793), according Rios (2009).

Nardo (1840), when describing *Cuspidaria*, stated that shells of species of this genus were heart-shaped, globose, symmetrical, prolonged anteriorly as a tubular beak from which the siphons extends, and open posteriorly (*sic*).

Carpenter (1864), on the basis of two right valves, described the type-species *Plectodon scaber* as having laminate lateral teeth. Palmer (1958), in revising mollusk species described by Philip Carpenter, observed the holotype was broken, incrustated with Bryozoa and composed by a single valve. Neither Carpenter (1864) nor Palmer (1958) mentioned the presence of surface granulations. The comparative use of external surface and number of teeth characters was made by Abbott (1974) and Keen (1971) who characterized the shell of genus *Plectodon* as having the form of *Cuspidaria*, but with the surface granulate or pustulate and the hinge with two lamellar lateral teeth, one anterior and the other posterior; whereas the genus *Cuspidaria* has a shell with a smooth surface and the hinge with only one lateral tooth. External surface is crucial to distinguish species of genera *Cuspidaria* and *Plectodon*.

Abbott (1974) mentioned only two species in *Plectodon*: *P. scaber* Carpenter, 1864 with a distribution from Puget Sound, Washington to Panama in the Pacific Ocean; and *Plectodon granulatus* (Dall, 1881), distributed from the Florida Keys to the West Indies, the only one for Atlantic Ocean. Poutiers and Bernard (1995) also mentioned other two species to Pacific Ocean: *Plectodon brazieri* E.A. Smith, 1885 and *Plectodon ligula* Yokoyama, 1922.

The present investigation establishes the first record of the genus *Plectodon* from the South Atlantic, by proposing the transfer of the species *Cuspidaria braziliensis* to that genus, resulting in the new combination *Plectodon braziliensis* (E. A. Smith, 1915). The shell of the species is redescribed.

Part of the material studied consisted of shells collected with a dredge (14 valves) and Van Veen grab (1 valve), at a depth of 99 m off Rio Grande, Rio Grande do Sul state (RS), Brazil, Radial 45, hydrographic station 6839 (32°55' S, 50°34' W), REVIZEE-Sul, on 4 April 1998, dredged by Oceanographic Vessel "Prof. Wladimir Besnard". The studied material was deposited in the mollusc collection of the Department of Zoology, Federal University of Rio Grande do Sul, Porto Alegre (UFRG), Brazil. Shells from other collections were analyzed: the Museum of Zoology of the University of São Paulo, São Paulo (MZSP); the Museum of Natural Sciences, Zoobotanical Foundation of Rio Grande do Sul, Porto Alegre (MCNZ); and the Prof. Eliézer de C. Rios Oceanographic Museum, Rio Grande (MORG), Brazil.

Type specimens (syntypes) of *Plectodon braziliensis* were also studied. They are housed in the Natural History Museum, London (BMNH), United Kingdom and photographs were sent by the curator. The specimen type of *Plectodon* genus, *Plectodon scaber*, was studied from high-resolution photographs of the material housed at National Museum of Natural History, Washington DC (NMNH).

The valves (UFRG 1646, 15 valves and MORG 38531, one valve) were photographed with a digital camera and on scanning electron microscope (SEM). They were drawn by means of a camera lucida.

Valves were considered adult when they had a concave posterior dorsal margin, the rostrum evident, and

measured more than 19.0 mm in length; we considered juveniles those with a straight posterior dorsal margin, the rostrum little evident, and not reached 14.0 mm in length.

Abbreviations used: N.Oc., “Navio Oceanográfico”, Oceanographic Vessel; REVIZEE, Avaliação do Potencial Sustentável de Recursos Vivos na Zona Econômica Exclusiva.

***Plectodon braziliensis* (E. A. Smith, 1915) n. comb.**

Cuspidaria braziliensis E. A. Smith, 1915: 104, pl. 2, Figure 23 (3 syntypes - BMNH 1915.4.18.509); Rios, 1970: 219; Rios, 1973: 197; Rios, 1975: 260-261, pl. 84, figure 1252; Rios, 1985: 280, figure 1382; Rios, 1994: 302, figure 1479; Rios, 2009: 605, figure 1674.

Cuspidaria ? braziliensis Poutiers and Bernard, 1995: 148.

Syntypes: 2 right and 1 left valves, off Rio de Janeiro, “Terra Nova” Expedition Station 42, 22°56' S, 41°34' W, 73 m, 02.V.1913, “Agassiz trawl” (BMNH 1915.4.18.509 - illustrated by E. A. Smith, 1915: Figure 23).

Type-locality: off Rio de Janeiro, Brazil, “Terra Nova” Expedition Station 42, 22°56'S, 41°34'W, 73 m depth.

Material examined: BRAZIL, Ceará: off Itapagé, 1 shell, 27.X.1967, I. Pq. M. leg. (MORG 14627). **Rio de Janeiro:** Praia Ilha Grande, 8 right and 9 left valves, 12.V.1966, N.Oc. “Emília” col. (MZSP 19936); Baía Ilha Grande, 1 shell, 16.II.1968, N.Oc. “W. Besnard” col. (MZSP 19937); off Bacia de Campos, 1 right and 1 left valve, 13.VII.1990 (MORG 28641); Cabo São Tomé (Cape St. Thomas, 22°24' S, 40°43' W), 1 shell, 10.II.1969, N.Oc. “W. Besnard” col. (MZSP 19567); Cabo São Tomé (22°34' S, 40°29' W), 2 left valves, 11.II.1969, N.Oc. “W. Besnard” col. (MZSP 19568); off Cabo Frio, 1 right valve, XI.1988 (MORG 27121). **Santa Catarina:** off Santa Marta, 1 right and 3 left valves, II.1987, N.Oc. “Atlântico Sul” col. (MORG 24966). **Rio Grande do Sul:** Est. 17 perfil de Tramandaí, 1 left valve, II.1987, N.Oc. “Atlântico Sul” col. (MORG 38531); off Solidão, 1 left valve, 14.X.1993, N.Oc. “Atlântico Sul” col. (MCNZ 34491); off Solidão, 3 left and 1 right valves, 14.X.1993, N.Oc. “Atlântico Sul” col. (MORG 31890); off Mostardas (31°03' S, 49°46' W), 06.VIII.1972, N.Oc. “W. Besnard” col. (MZSP 19109); off Rio Grande (REVIZEE Station 6839, 32°55' S, 50°34' W), 8 right and 7 left valves, 4.IV.1998, N.Oc. “W. Besnard” col. (UFRG 1646); off Rio Grande, 2 left valves (broken), V.1969, N.Oc. “Mestre Jerônimo” col. (MORG 14046); off Albardão, 1 left valve, III.1972, N.Oc. “Almirante Saldanha” col. (MORG 18080); REVIZEE Station C 76, 1 right and 1 left valve, 30.IV.1996, Absalão leg. (MORG 41286).

Other material examined: *Plectodon scaber* UNITED STATES, California: Catalina Island, 1 valve, J.G. Cooper leg. (NMNH 592441, holotype).

Geographical distribution: Brazil (off states of Ceará, Rio de Janeiro, Santa Catarina and Rio Grande do Sul) (Figure 1).

Habitat: sand with biodebris (present study), muddy sand (Rios 1975; Rios 1994; Rios 2009).

Redescription: valves rostrate, length nearly twice the height (biggest syntype: 26.81 x 15.57 mm - Figure 2, biggest specimen: 29.00 x 17.50), color dirty white, inequilateral. Umbo subcentral anterior, obtuse, weakly prosogyrous, prodissoconch distinct, smooth (Figure 15). Anterodorsal margin obliquely straight; posterodorsal margin concave in valves of adults (Figures 2, 16) and obliquely straight in juveniles (Figures 3, 19); anterior margin rounded, ventral

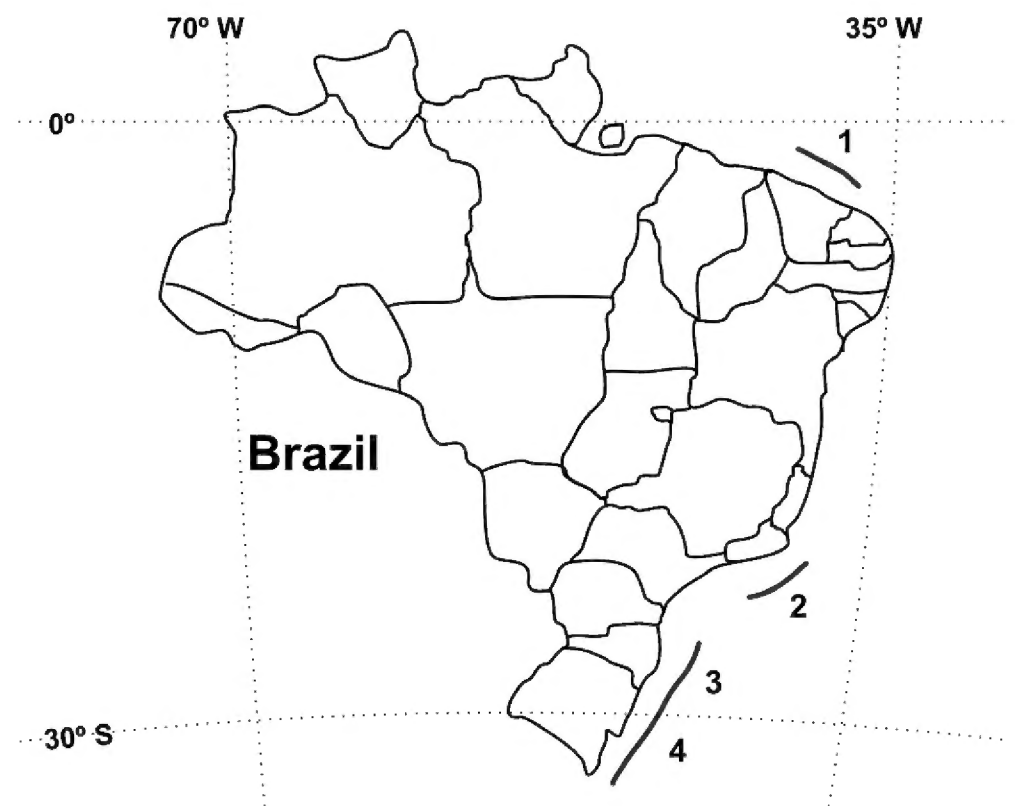


FIGURE 1. Records of *Plectodon braziliensis* (E.A. Smith, 1915) to Brazilian coast. 1. Off Ceará. 2. off Rio de Janeiro. 3. off Santa Catarina. 4. off Rio Grande do Sul.

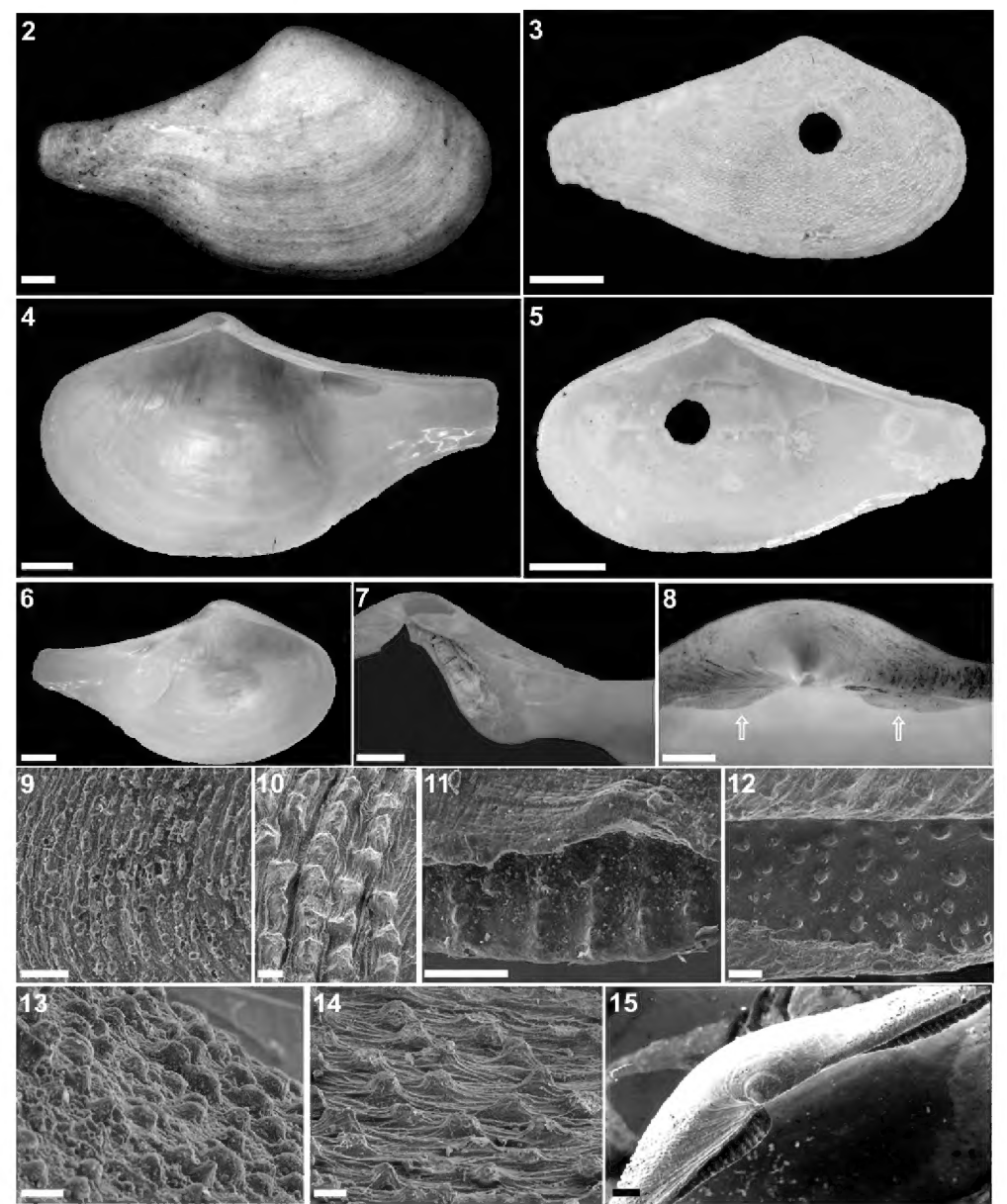


FIGURE 2-15. *Plectodon braziliensis* (E.A. Smith, 1915). 2. Syntype, external view, adult valve, BMNH 1915.4.18.509/1. 3-5, 7-14. Right valve, UFRG 1646, bar = 1 mm. 3. Young valve, external view, bar = 1 mm. 4. Internal view, adult valve, bar = 3 mm. 5. Internal view, young valve, bar = 1 mm. 6. Left adult valve, bar = 3 mm. 7. Detail of chondrophore, bar = 0.5 mm. 8. Detail of two right valve lateral teeth, anterior and posterior ones, bar = 2 mm. 9-10. Details of the rostrum dorsal region granules, arranged in transversal rows, bar = 100 µm. 11-12. Details of surface granules in valve central region, not in rows, bars = 50 µm and bar = 100 µm. 13-14. Details of granules in dorsal region of lateral posterior tooth, bar = 100 µm. 13. Young valve, granules in radial rows. 14. Adult valve, dispersal granules. 15. Umbones, smooth, young valve, MORG 38531, bar = 200 µm.

margin weakly rounded, becoming concave posteriorly. Rostrum elongate, principally in adults (Figures 2, 16); end truncate. External surface with many, randomly arranged granules (Figures 11, 12, 16, 19); near rostrum granules larger and organized in transverse lines (Figures 9, 10, 16, 19); some fine growth lines may be present

(Figure 16); no radial ornamentation. Lunule small, larger in left valve, without granules. Chondrophore below umbo, posterior to prodissoconch, partly hidden, elliptical and inclined dorso-posterior/ventrally (Figure 7). Hinge, on right valve, with two lamellar lateral teeth, one anterior and one posterior (Figures 8, 17, 20); left valve edentate or with one posterior lamellar lateral tooth, less evident, as prolongation of dorsal margin (Figures 6, 18); lateral teeth smooth on ventral side and with granules on dorsal surface, these granules arranged radially in juveniles (Figure 13) and randomly in adults (Figure 14); right valve with elongated pits above teeth; cardinal teeth absent. Inner surface of valve smooth, somewhat shiny (Figures 4, 5, 6), whitish. Pallial line well marked and pallial sinus rounded, short and wide (Figures 17, 18, 20). Muscle scars evident: anterior adductor large, posterior adductor smaller, located at beginning of rostrum, just below and behind posterior lateral tooth; posterior muscle of septum relatively large and located anterior to posterior adductor scar; some circular muscle scars may be present (Figure 18).

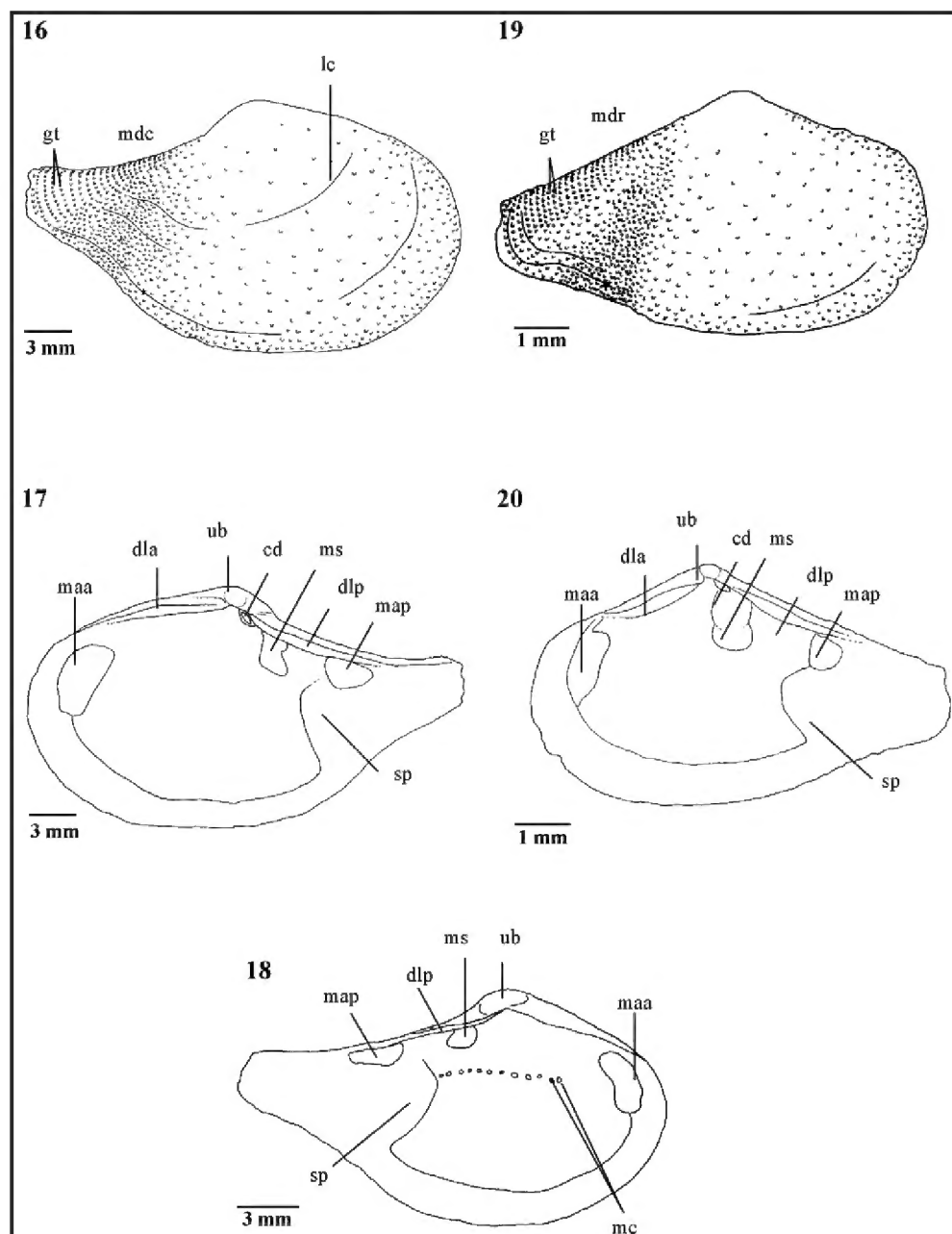


FIGURE 16-20. *Plectodon braziliensis* (E.A. Smith, 1915). **16-18.** Adult. **16.** Right valve, external view. **17.** Right valve, internal view. **18.** Left valve, internal view. **19-20.** Young, right valve. **19.** External view. **20.** Internal view. cd-Chondrophore. dla-lateral anterior tooth. dlp-lateral posterior tooth. gt-granules arranged in transversal rows. lc-growth line. maa-anterior adductor muscle scar. map-posterior adductor muscle scar. mc-circular muscles scars. mdc-concave dorsal posterior edge. mdr-straight dorsal posterior edge. ms-septum muscle scar. sp-pallial sinus. ub-umbone.

Specimens collected off Rio Grande do Sul to this work were identical when compared to syntypes. The biggest, for example, was similar in form and it had almost the same length and high measurements of the biggest syntype.

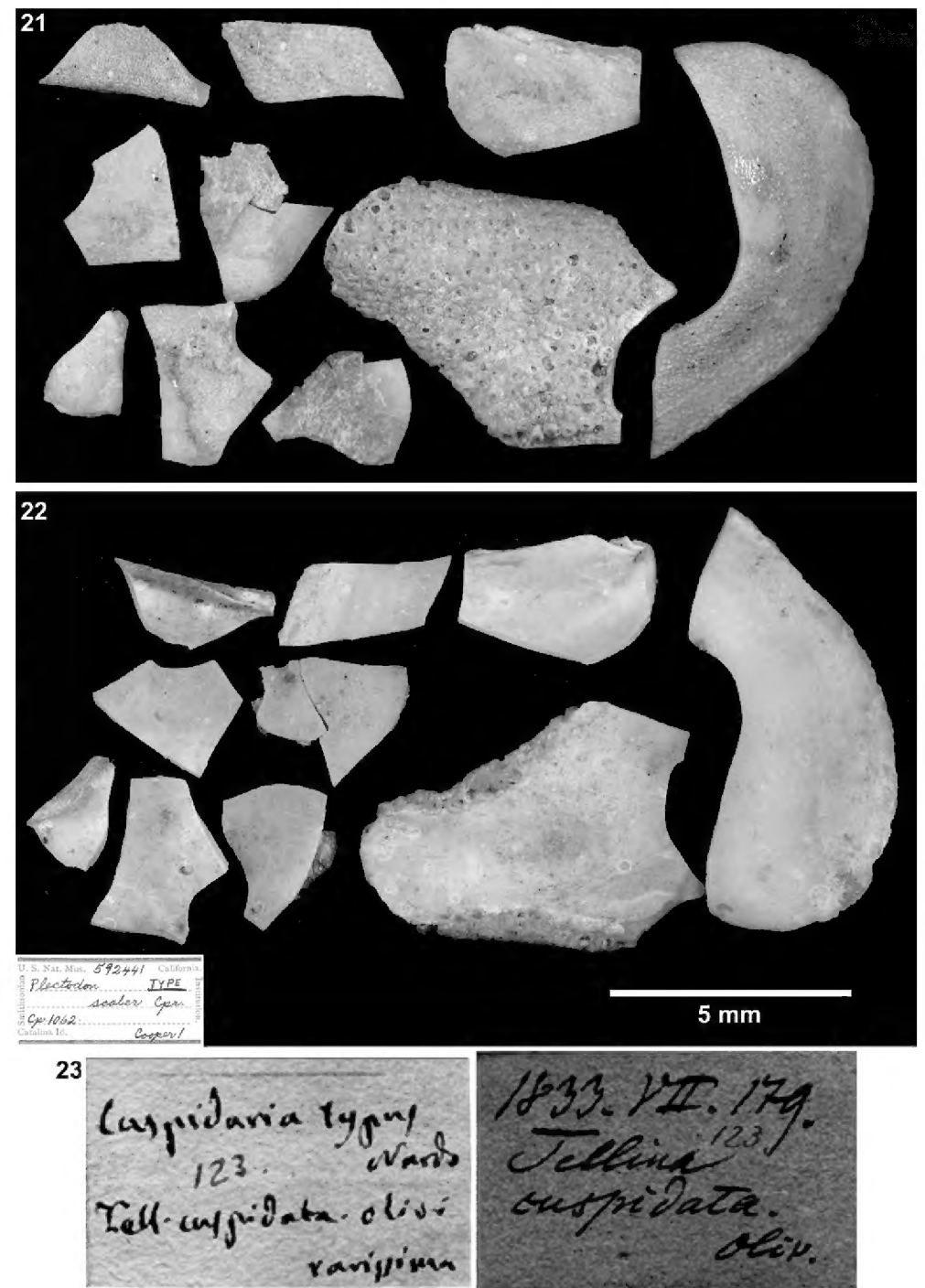


FIGURE 21-22. *Plectodon scaber* holotype (NMNH 592441), showing the characteristics granules at external surface and internal surface with detail of label. **23.** Labels of the probable missing holotype of *Cuspidaria typus* from Naturhistorisches Museum, Wien.

Analyzing the diagnostic characters of *Plectodon* and *Cuspidaria*, according to Abbott (1974), Keen (1963, 1971), Moore (1969) and Poutiers and Bernard (1995), the species *P. braziliensis*, as described by Smith (1915) and represented by sampled specimens, is appropriately assigned to the genus *Plectodon* because of its pustulate or granular surface ornamentation. The diagnostic external surface granules of *Plectodon* can be until observed on *Plectodon scaber* holotype, genus type-species, which was broken and incrustated by Bryozoa (Figures 21 and 22). *Cuspidaria typus*, type species of *Cuspidaria* could not be found and analysed. According to Cecília Vianello and Anita Eschner curators of Museo di Storia Naturale di Venezia, Venice and Naturhistorisches Museum, Wien, collections where the material could be possibly housed, this was lost. At Naturhistorisches Museum only labels were found, possibly from type material (Figure 23). According to Cecília Vianello (*in litteris*), Pirona (1878) mentioned Nardo's types were housed at Wien museum. Surface granules were not mentioned on *Cuspidaria* and *Plectodon* original descriptions. Smith (1915) noted that such ornamentation is uncommon in *Cuspidaria*, which has the surface smooth, and the hinge with two lamellar lateral teeth on the right valve, instead of one. Abbott (1974) did not specify the number of lateral teeth on the right valve in species of *Plectodon*, but stated that species of *Cuspidaria* have one posterior lateral tooth on this valve. Keen (1971),

on the other hand, emphasized that *Plectodon* has one anterior and one posterior tooth, both lamellar, which is evident in the illustration by Keen (1971) of these teeth on the right valve. Poutiers and Bernard (1995) remained in doubt concerning *P. braziliensis* belonging to *Cuspidaria* genus. In accordance with these observations, we propose the transfer of the species *Cuspidaria braziliensis* to the genus *Plectodon*, resulting in the new combination *Plectodon braziliensis* (E. A. Smith, 1915).

This is, therefore, the first record of *Plectodon* for the South Atlantic and the Brazilian coastal zone (see Rios 2009; Scarabino 2003; Forcelli 2000).

As external surface, granulations were observed in lateral teeth. Smith (1915), in his description of *Plectodon braziliensis*, did not record granulations on the lateral teeth. Subsequent authors did not mention this characteristic (see Rios 2009). It should be mentioned that the difference found in the slope of the rostrum between smaller and larger specimens was observed by Krylova (1993) in *Bathyneera* specimens. In both cases larger shells have concave dorsal margin.

Plectodon braziliensis differs from *P. scaber* that occurs in the Pacific Ocean (Carpenter 1864) by rose-tinged umbo (Keen 1971). *Plectodon granulatus*, which according to Abbott (1974) occurs in the Atlantic Ocean and can reach 12 mm in length, is smaller than *P. braziliensis*, which can reach 34 mm (Rios 2009).

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LITERATURE CITED

- Abbott, R.T. 1974. *American seashells*. New York: Van Nostrand Reinhold. 663 p.
- Carpenter, P.P. 1864. Supplementary report on the present state of our knowledge with regard to the Mollusca of the West coast of North America. *Report of the meeting of the British Association for the Advancement of Science* 33: 611-638.
- Forcelli, D.O. 2000. *Moluscos Magallánicos: guía de moluscos de Patagonia y sur de Chile*. Buenos Aires: Vazquez Mazzini Editores. 200 p.
- Keen, A.M. 1963. *Marine molluscan genera of Western North America: an illustrated key*. California: Stanford University Press. 126 p.
- Keen, A.M. 1971. *Seashells of tropical West America: marine mollusks from Baja California to Peru*. 2. ed. California: Stanford University Press. 1064 p.
- Krylova, H.M. 1993. Bivalve molluscs of the genus *Bathyneera* (Septibranchia, Cuspidariidae) of the World Ocean. *Ruthenica* 3(1): 51-59.
- Moore, R.C. 1969. *Treatise on invertebrate paleontology. Mollusca. 6. Bivalvia*. Part N, v. 2. Lawrence: The Geological Society of America. 952 p.
- Nardo, L. 1840. *Congresso degli Scienziati Italiani 1839*. Pisa: Nistri. 202 p.
- Palmer, K.V.W. 1958. Type specimens of marine Mollusca described by P. P. Carpenter from the West Coast (San Diego to British Columbia). *The Geological Society of América Memoir* 76: 1-376.
- Pirone, G.A. 1878. Della vita e degli studii di Gian Domenico Nardo. Commemorazione - *Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti*, Venezia, 5 (6): 785-850.
- Poutiers, J.M. and F.R. Bernard. 1995. Carnivorous bivalve molluscs (Anomalodesmata) from the tropical western Pacific Ocean, with a proposed classification and a catalogue of recent species; p. 107-187 *In* P. Bouchet (ed). *Résultats des Campagnes MUSORSTOM*, v. 14. Paris: Mémoires du Muséum National d'Histoire Naturelle.
- Rios, E.C. 1970. *Coastal Brazilian seashells*. Rio Grande: Editora da FURG. 255 p.
- Rios, E.C. 1973. Moluscos marinos de la Expedición GEOMAR IV. *Comunicaciones de la Sociedad Malacológica del Uruguay* 3(23-24): 193-200.
- Rios, E.C. 1975. *Brazilian marine mollusks iconography*. Rio Grande: FURG. 331 p.
- Rios, E.C. 1985. *Seashells of Brazil*. Rio Grande: FURG. 329 p.
- Rios, E.C. 1994. *Seashells of Brazil*. 2. ed. Rio Grande: FURG. 368 p.
- Rios, E.C. 2009. *Compendium of Brazilian Sea Shells*. Rio Grande: Evangraf. 668 p.
- Scarabino, F. 2003. Lista sistemática de los Bivalvia Marinos y Estuarinos vivientes de Uruguay. *Comunicaciones de la Sociedad Malacológica del Uruguay* 8(80-81): 227-258.
- Smith, E.A. 1915. British Antarctic ("Terra Nova") Expedition, 1910. Mollusca. Part I. - Gastropoda Prosobranchia, Scaphopoda, and Pelecypoda. *Natural History Report. Zoology* 2(4): 61-112.

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